REMARKS

Claims 1-3, 5-9 and 11-16 are pending in this application. By this Amendment, claims 8 and 11 are amended to more clearly define the subject matter being claimed. Support for the amendments to the claims may be found, for example, in the specification at page 9, lines 1-3. No new matter is added.

The Advisory Action mailed January 14, 2010, states that the rejection of claims 1-3, 5-9, and 11-16 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention has been overcome. Accordingly Applicants respectfully request withdrawal of the rejection.

I. Rejections Under 35 U.S.C. §103

The Office Action rejects claims 1-3, 5-9, and 11-16 under 35 U.S.C. §103(a) over U.S. Patent No. 6,956,098 to Summers et al. (hereinafter "Summers"); rejects claims 1-3, 5, 7-9, and 11-16 under 35 U.S.C. §103(a) over U.S. Patent Application Publication No. 2001/003020122 to Hara et al. (hereinafter "Hara"); rejects claims 1-3 and 5-7 under 35 U.S.C. §103(a) over U.S. Patent No. 4,937,133 to Watanabe et al. (hereinafter "Watanabe"); rejects claims 1-3, 5-9, and 11-16 under 35 U.S.C. §103(a) over U.S. Patent No. 6,824,827 to Katsuki et al. (hereinafter "Katsuki"); and rejects claims 1-3, 5-9, and 11-16 under 35 U.S.C. §103(a) over U.S. Patent Application Publication 2006/0115670 to Tanaka et al. (hereinafter "Tanaka"). The Advisory Action mailed January 14, 2010, states that the 35 U.S.C. §103(a) rejection over Watanabe has been overcome. Applicants respectfully traverse the remaining rejections.

The Advisory Action asserts that all of the references teach forming the metal layer by vapor deposition after surface treating the thermoplastic film layer. Applicants respectfully disagree.

The applied references at least fail to teach, suggest, or establish any reason or rationale to provide "at least one or more kind of element selected from Si, Ti, and Al are contained in an organic substance from the joining interface toward the metal layer, and the metal layer is formed on the thermoplastic film layer by a vapor deposition method," as recited in claim 1, and "before the metal layer is formed by a vapor deposition method, an organic substance containing at least one or more kind of element selected from Si, Ti, and Al is deposited directly on the thermoplastic film layer," recited in claim 8.

A. Summers

Summers discloses a laminate that is produced by applying an adhesive layer onto the polyimide film, and then laminating a conductive foil. See Summers, col. 12, line 55 to col. 13, line 39, reproduced below for convenience.

> Polyimide films according to the present invention can be used as a base film for a laminate for incorporation into a flexible printed circuit board ("FPC"). In one embodiment, a flexible printed circuit board ("FPC") can be produced as follows: 1. applying an adhesive (onto the polyimide film of the present invention) and drying; 2. laminating a copper or other conductive foil; 3. hardening the adhesive; and 4. forming a circuit pattern (broadly speaking: application of a resist, photo-patterning and development of the resist, copper etching and removal of the resist).
>
> Examples of adhesives useful in forming the adhesive layer include thermoplastic polyimide resins, epoxy resins, phenolic resins, melamine resins, acrylic resins, cyanate resins and combinations thereof. In one embodiment, the adhesive is a polyimide thermoplastic resin, optionally further comprising a thermosetting adhesive, such as, epoxy resin and/or phenolic resin. For adhesives having both thermoplastic and thermosetting components, the content of the thermosetting resin in the adhesive layer generally ranges from 5 to 400 parts by weight, preferably from 50 to 200 parts by weight, per 100 parts by weight of resin components other than the thermosetting resin.
>
> In alternative embodiments, the adhesive is omitted. The adhesive may be omitted by casting polyamic acid solution onto a metal substrate, and thereafter drying and curing the polyamic acid solution to create the polyimide film. Alternatively: i. a polyimide film of the present invention can be sputtered with a metal; or ii. the metal and polymer layers can be bonded together by heat and pressure.
>
> The FPC should have high dimensional stability, and this can be obtained with the polyimide films of the present invention, due in particular to the advantageously high modulus and excellent match of

> coefficient of linear thermal expansion to copper and other conductive materials.
>
> The adhesion strength of the above-described laminates can be improved by employing various techniques for elevating adhesion strength. For example, prior to the step of applying the adhesive onto the polyimide film or laminating an adhesive sheet thereon, the polyimide film can be subjected to a pre-treatment step (heat treatment, corona treatment, plasma treatment under atmospheric pressure, plasma treatment under reduced pressure, treatment with coupling agents (like polyamic acids oligomers and silanes), sandblasting, alkali-treatment, acid-treatment, etc.). To improve the adhesion strength, it is generally also possible to add various metal compounds as disclosed, for example, in U.S. Pat. No. 4,742,099 incorporated herein by reference, (tin compounds, titanium compounds, etc.) to the polyamide acid or to apply various metal compound solutions onto the gel film.

Thus, Summers discloses that "prior to the step of applying the adhesive onto the polyimide film or laminating an adhesive sheet thereon, the polyimide film can be subjected to a pre-treatment step," including a treatment with coupling agents. See Summers, col. 13, lines 24-33.

Although Summers discloses that the polyimide film can be pre-treated with coupling agents, Summers fails to disclose that the adhesive layer, which is in direct contact with the conductive foil, can be pre-treated with coupling agents. In Summers, because the conductive foil is not in direct contact with the pre-treated polyimide film, the component of the coupling agents cannot join "toward the conductive layer," as recited in claim 1. Likewise, Summers clearly fails to disclose that the component of the coupling agents "is deposited directly on the thermoplastic film layer," as recited in claim 8.

Therefore, for at least the reasons set forth above, one having ordinary skill in the art at the time of the invention would not have been motivated to subject a plastic to pretreatment steps with coupling agents with a reasonable expectation of successfully achieving the metal coated substrate and manufacturing method of a metal-coated substrate of claims 1 and 8, respectively.

Accordingly, for at least the foregoing reasons, Applicants respectfully submit that claims 1 and 8 would not have been rendered obvious by Summers. Therefore, claims 1 and 8 and their dependent claims are patentable. Accordingly, reconsideration and withdrawal of this rejection are respectfully requested.

B. Hara

Hara discloses a process for producing a laminate comprising forming a conductor layer directly on a thermoplastic polyimide surfaces, and heating the laminate so that a polyimide and a conductor layer are directly thermally fused. See Hara, claim 1.
The Office Action asserts quotes Hara's disclosure in paragraph [0044], "[t]he effects of the invention are not worsened by physically roughening the polyimide surface before the formation of the conductor layer, roughening the polyimide surface by a plasma treatment in an inert gas and/or introducing a functional group, or using an adhesive metal layer to thereby **further enhance** the adhesion strength' and hence Hara do provide a suggestion of further enhancing the adhesion strength by these methods" (emphasis added in the Office Action). See Office Action, page 4.

However, Hara merely discloses that the adhesion strength can be enhanced by roughening the polyimide surface with physical or plasma treatment, or by using an adhesive metal layer. Thus, Hara fails to provide any suggestion to use coupling agents on the surface of the polyimide film. Further, Hara stresses the excellent adhesion strength between the conductor layer and the polyimide without conducting any surface roughening treatment or using any adhesive undercoating metal layer (paragraph [0044]), and thus there is no showing of a reason or rationale why a person of ordinary skill in the art would have provided the claimed features based on the teachings of Hara and/or modified the teachings of Hara any reasonable expectation of success of achieving predictable results.

For at least the foregoing reasons, Applicants respectfully submit that claims 1 and 8 would not have been rendered obvious by Hara. Therefore, claims 1 and 8 and their dependent claims are patentable. Accordingly, reconsideration and withdrawal of this rejection are respectfully requested.

C. Katsuki

Katsuki merely discloses a polyimide film in which surface was treated by a solution before forming a metal layer on the surface of the polyimide film. See Katsuki, col. 2, lines 25-40, reproduced below for convenience.

> The present invention relates to a method of surface treating a polyimide film having a biphenyltetracarboxylic acid component which comprises treating the surface of the film by contact to a solution, preferably immersion in a solution, containing at least one of potassium permanganate and sodium permanganate and at least one of potassium hydroxide and sodium hydroxide and treating the film surface with an acid thereby to improve the adhesion to metal.
>
> The present invention also relates to a polyimide film having a thin metal layer which is composed of a polyimide film having been surface treated by the above-described method to have improved adhesion to metal and a metal layer formed on the surface-treated side of the polyimide film by vapor deposition or a combination of vapor deposition and plating.

Katsuki fails to provide any suggestion to reform the surface of the polyimide film by use of coupling agents. Without such a disclosure, there would have been no reason for one of ordinary skill in the art to achieve the features, as required by claims 1 or 8, and/or (2) modify the teachings of Katsuki in order to achieve the claimed features. Clearly, the only motivation for modifying the applied references in the manner asserted by the Examiner improperly comes from the present claims and disclosure.

For at least the foregoing reasons, Applicants respectfully submit that claims 1 and 8 would not have been rendered obvious by Katsuki. Therefore, claims 1 and 8 and their dependent claims are patentable. Accordingly, reconsideration and withdrawal of this rejection are respectfully requested.

D. Tanaka

Tanaka discloses that the surface of a thermoplastic polyimide resin film is roughened by contact with a surface-roughened metal foil to copy a surface unevenness shape thereof, or by performing corona discharge treatment to the surface of the thermoplastic polyimide resin film, and a metal layer is formed on the roughened surface of thermoplastic polyimide resin film by an electroless plating method or a sputtering method. See Tanaka, paragraphs [0072] and [0076].

However, Tanaka does not disclose applying coupling agents on the surface of thermoplastic polyimide resin film. Instead, Tanaka merely discloses that "[i]n addition, the polyimide resin composition solution may be combined with an ordinary epoxy curing agent such as an acid anhydride, e.g., an acid dianhydride, an amine, imidazole, or the like, an accelerator, any one of various coupling agents, according to the purposes for improving water absorption, heat resistance, adhesiveness, and the like." See Tanaka, paragraph [0134].

Thus, Tanaka discloses that various coupling agents may be added in the polyimide resin composition solution, which is a raw material of the polyimide resin film. Therefore, when a coupling agent is added in the polyimide resin composition solution, the coupling agent is mixed the raw material and ends up being distributed or buried in the formed polyimide resin film. Thus, the disclosure of Tanaka, such as in paragraph [0134] of Tanaka fails to provide any reason or rationale to provide "at least one or more kind of element selected from Si, Ti, and Al are contained in an organic substance from the joining interface toward the metal layer," as recited in claim 1, as well as the recitation of "at least one or more kind of element selected from Si, Ti, and Al is deposited directly on the thermoplastic film layer," as recited in claim 8. Further, there is no showing of a reason or rationale why a

person of ordinary skill in the art would have made the claimed invention based on the teachings of Tanaka with any reasonable expectation of success.

For at least the foregoing reasons, Applicants respectfully submit that claims 1 and 8 would not have been rendered obvious by Tanaka. Therefore, claims 1 and 8 and their dependent claims are patentable. Accordingly, reconsideration and withdrawal of this rejection are respectfully requested.

Patentability of the claims is further supported by unexpected results. By having the element of "before the metal layer is formed by a vapor deposition method, an organic substance containing at least one or more kind of element selected from Si, Ti, and Al is deposited directly on the thermoplastic film layer, as recited in claim 8, or "at least one or more kind of element selected from Si, Ti, and Al are contained in an organic substance from the joining interface toward the metal layer, and the metal layer is formed on the thermoplastic film layer by a vapor deposition method," as recited in claim 1, the claimed invention provides unexpected results that the adhesion between the thermoplastic film layer and the metal layer is effectively improved. In the claimed substrate and manufacturing method, the component of coupling agents extends from the joining interface toward inside the metal layer; in a formation process of the metal layer by a vapor deposition, metal atoms can break into the gap between the coupling agents adhering on the surface of thermoplastic film layer; the coupling agents are driven into the metal layer as wedges is formed; then the adhesion between the thermoplastic film layer and the metal layer is effectively improved. These benefits are not disclosed, suggested or even attainable by the applied references.

Accordingly, for at least the foregoing reasons, Applicants respectfully submit that claims 1 and 8 would not have been rendered obvious by the applied references. Therefore, claims 1 and 8 and their dependent claims are patentable. Accordingly, reconsideration and withdrawal of this rejection are respectfully requested.

II. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of the application are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

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Attachment:
Request for Continued Examination

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